Appendix L

Floodplain/Wetlands Assessment
for the Proposed Yucca Mountain
Geologic Repository

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APPENDIX L. FLOODPLAIN/WETLANDS ASSESSMENT FOR THE PROPOSED YUCCA MOUNTAIN GEOLOGIC REPOSITORY

L.1 Introduction

Pursuant to Executive Order 11988, *Floodplain Management*, each Federal agency is required, when conducting activities in a floodplain, to take actions to reduce the risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Pursuant to Executive Order 11990, *Protection of Wetlands*, each Federal agency is to avoid, to the extent practicable, the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands if a practicable alternative exists. Regulations issued by the U.S. Department of Energy (DOE) that implement these Executive Orders are contained in Title 10 of the Code of Federal Regulations (CFR) Part 1022, *Compliance with Floodplain/Wetlands Environmental Review Requirements*.

In 1982, Congress enacted the Nuclear Waste Policy Act in recognition of the national problem created by the accumulation of spent nuclear fuel and high-level radioactive waste at many commercial and DOE sites throughout the country. The Act recognized the Federal government's responsibility to permanently dispose of the Nation's spent nuclear fuel and high-level radioactive waste. By 1986, DOE narrowed the number of potentially acceptable geologic repository sites to three. Then in 1987, Congress amended the Act by redirecting DOE to determine the suitability of only Yucca Mountain in southern Nevada.

If, after a possible recommendation by the Secretary of Energy, the President considers the site qualified for an application to the U.S. Nuclear Regulatory Commission for a construction authorization, the President will submit a recommendation of the site to Congress. If the site designation becomes effective, the Secretary of Energy will submit to the Nuclear Regulatory Commission a License Application for a construction authorization. DOE would also select a rail corridor or a site for an intermodal transfer station, along with its associated route for heavy-haul trucks, among those considered for Nevada in the EIS. Following such a decision, additional field surveys, environmental and engineering analyses, and National Environmental Policy Act reviews would likely be needed regarding a specific rail alignment for the selected corridor. When more specific information becomes available about activities proposed to take place within floodplains and wetlands, DOE will conduct further environmental review in accordance with 10 CFR 1022.

In 1989, DOE published a Notice of Floodplain/Wetlands Involvement (54 *FR* 6318, February 9, 1989) for site characterization studies at Yucca Mountain. These studies are designed to determine the suitability of Yucca Mountain to isolate nuclear waste. A floodplain assessment was prepared (DIRS 104559-YMP 1991, all) and a Statement of Findings was issued by DOE (56 *FR* 49765, October 1, 1991). In 1992, DOE prepared a second floodplain assessment on the cumulative impacts of surface-based investigations and locating part of the Exploratory Studies Facility in the 100-year floodplain of a wash at Yucca Mountain (DIRS 103197-YMP 1992, all). The Statement of Findings for this assessment was published in the Federal Register (57 *FR* 48363, October 23, 1992). Both Statements of Findings concluded that the benefits of locating activities and structures in the floodplains outweigh the potential adverse impacts to the floodplains and that alternatives to these actions were not reasonable.

The Nuclear Waste Policy Act, as amended, requires that a recommendation by the Secretary to the President to construct a repository must be accompanied by a Final EIS. As part of the EIS process, and following the requirements of 10 CFR Part 1022, DOE issued a *Notice of Floodplain and Wetlands Involvement* in the *Federal Register* (64 *FR* 31554, June 11, 1999). The Notice requested comments from the public regarding potential impacts on floodplains and wetlands associated with construction of a potential rail line or a potential intermodal transfer station with its associated route for heavy-haul trucks

to and in the vicinity of Yucca Mountain, depending on the rail or intermodal alternative selected (Figure L-1). DOE received no comments from the public. This floodplain/wetlands assessment has been prepared in conjunction with the *Notice of Floodplain and Wetlands Involvement*, and in accordance with 10 CFR Part 1022 and was made available to the public as part of the Draft EIS. Several comments were received dealing with this floodplain/wetlands assessment during the public comment period for the Draft EIS. In addition to changes driven by some of these comments, this floodplain/wetlands assessment now includes a statement of findings as Section L.7.

This assessment examines the effects of proposed repository construction and operation and potential construction of a rail line or intermodal transfer station on:

1. Floodplains near the Yucca Mountain site (Fortymile Wash, Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash; there are no delineated wetlands near the Yucca Mountain site), and

2. Floodplains and areas that may have wetlands (for example, springs and riparian areas) along potential rail corridors in Nevada and at intermodal transfer station locations associated with routes for heavy-haul trucks. If DOE selects rail as the mode of spent nuclear fuel and high-level radioactive waste transport in Nevada to the Yucca Mountain site, one of five rail corridors would be selected (Figure L-2). If DOE selects heavy-haul as the mode of transport for spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site, one of five heavy-haul truck routes and one of three intermodal transfer station locations would be selected (Figure L-3). A more detailed floodplain/wetlands assessment of the selected rail corridor or route for heavy-haul trucks would then be prepared. This assessment compares what is known about the floodplains, springs, and riparian areas along the five possible rail corridors and at the three intermodal transfer station locations. This assessment does not evaluate potential floodplain or wetlands effects along heavy-haul truck routes because these existing roads should already be designed to meet 100-year floodplain design specifications. If upgrades to existing roads are deemed necessary, a more detailed floodplain/wetlands assessment would be prepared at that time.

Title 10 CFR Part 1022.4 defines a flood or flooding as "…*a temporary condition of partial or complete inundation of normally dry land areas from...the unusual and rapid accumulation of runoff of surface waters...*" Title 10 CFR Part 1022.4 identifies floodplains that must be considered in a floodplain assessment as the *base floodplain* and the *critical-action floodplain*. The base floodplain is the area inundated by a flood having a 1.0 percent chance of occurrence in any given year (referred to as the 100-year floodplain). The critical-action floodplain is the area inundated by a flood having a 0.2 percent chance of occurrence in any given year (referred to as the 500-year floodplain). *Critical action* is defined as any activity for which even a slight chance of flooding would be too great. Such actions could include the storage of highly volatile, toxic, or water-reactive materials. The critical-action floodplain was considered because petroleum, oil, lubricants, and other hazardous materials could be used during the construction of a rail line or road upgrades and because spent nuclear fuel and high-level radioactive waste would be transported across the washes.

Title 10 CFR Part 1022.11 requires DOE to use Flood Insurance Rate Maps or Flood Hazard Boundary Maps to determine if a proposed action would be located in the base or critical-action floodplain. On Federal or state lands where Flood Insurance Rate Maps or Flood Hazard Boundary Maps are not available, DOE is required to seek flood information from the appropriate land-management agency or from agencies with expertise in floodplain analysis. The U.S. Geological Survey was therefore asked by DOE to complete a flood study of Fortymile Wash and its principal tributaries (which include Busted Butte, Drill Hole, and Midway Valley washes) and outline areas of inundation from 100-year and 500-year floods (DIRS 102783-Squires and Young 1984, Plate 1).

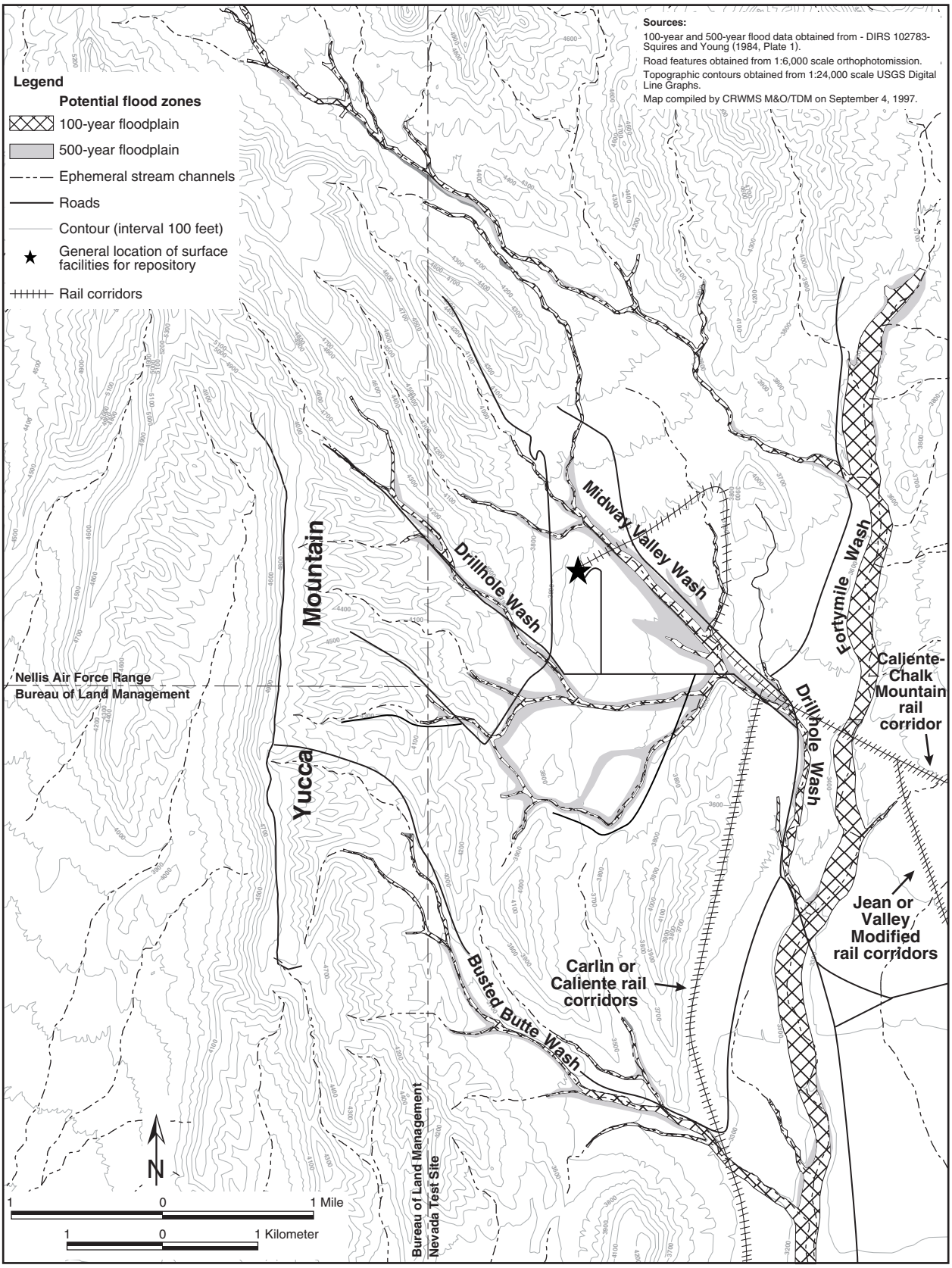

Figure L-1. Yucca Mountain site topography, floodplains, and potential rail corridors.

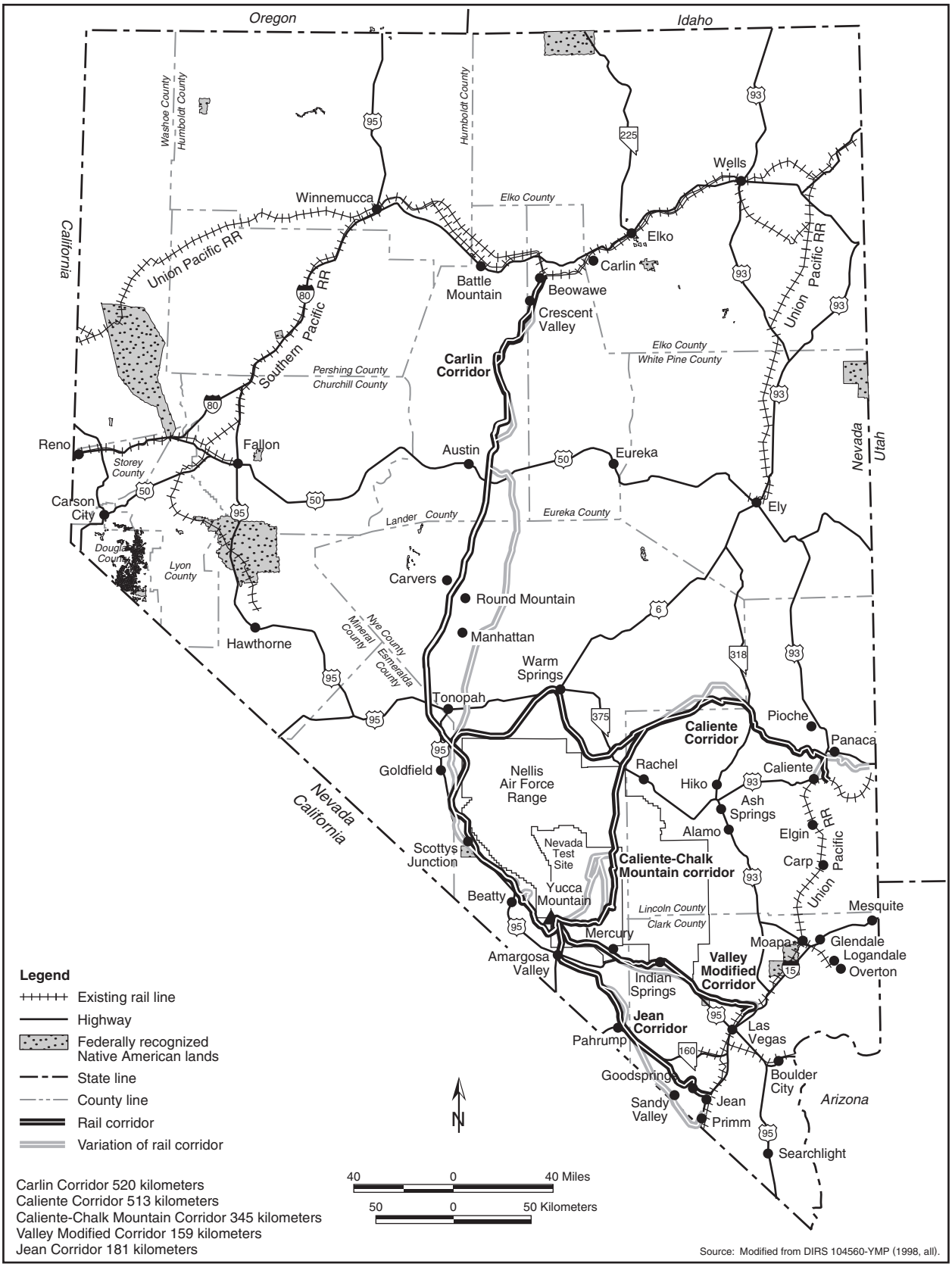

Figure L-2. Potential Nevada rail corridors to Yucca Mountain.

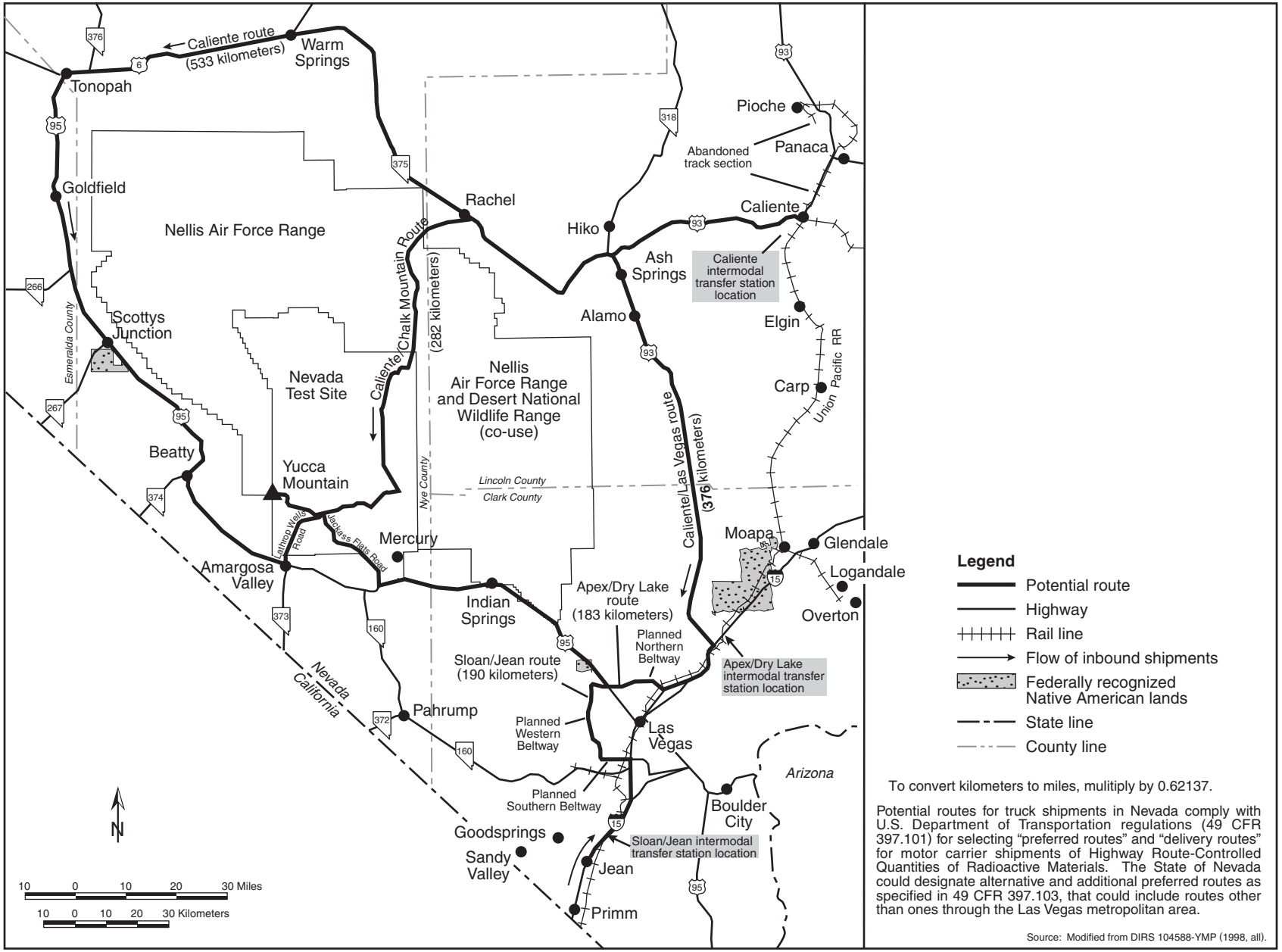

Figure L-3. Potential routes in Nevada for heavy-haul trucks.

Title 10 CFR Part 1022 also requires DOE to determine whether wetlands would be affected by the proposed action and, if necessary, to conduct a wetlands assessment. As required by 10 CFR Part 1022.11(c), DOE examined the following information with regard to possible wetlands in the vicinity of the Yucca Mountain site:

- *U.S. Fish and Wildlife Service National Wetlands Inventory.* Maps from the National Wetlands Inventory do not identify any naturally occurring wetlands in the vicinity of the Yucca Mountain site (DIRS 147930-FWS 1995, all).

- *U.S. Department of Agriculture, Soil Conservation Service Local Identification Maps.* The Soils Conservation Service (now called Natural Resource Conservation Service) has not conducted a soil survey of the Yucca Mountain site. However, DOE and other agencies have conducted comprehensive surveys and studies of soils at the Yucca Mountain site and in the surrounding area. These surveys are summarized in DIRS 104592-CRWMS M&O (1999, pp. 2 to 6). The surveys indicate that there are no naturally-occurring hydric soils at Yucca Mountain.

- *U.S. Geological Survey Topographic Maps.* Topographic maps of the vicinity (for example, DIRS 147932-USGS 1983, all) do not show springs, permanent streams, or other indications of wetlands.

- *State Wetlands Inventories.* There are no State of Nevada wetlands inventories in the vicinity of Yucca Mountain.

- *Regional or Local Government-Sponsored Wetlands or Land-Use Inventories.* DOE has conducted a wetlands inventory of the Nevada Test Site (DIRS 101833-Hansen et al. 1997, p. 1-161). The closest naturally occurring wetlands to Yucca Mountain is on the upper west slope of Fortymile Canyon, 6 kilometers (3.7 miles) north of the North Portal, outside of the proposed repository construction area. In addition, riparian vegetation occurs adjacent to four manmade well ponds east of Yucca Mountain (DIRS 104593-CRWMS M&O 1999, p. 2-14), but these are outside of areas where construction or other proposed actions would occur.

Based on this information, DOE concluded that a wetlands assessment is not required to comply with 10 CFR Part 1022.

L.2 Project Description

If Yucca Mountain is selected as a site to construct a repository, DOE would ship spent nuclear fuel and high-level radioactive waste to the site for a period of about 24 years. For analysis purposes, DOE assumed that spent nuclear fuel and high-level radioactive waste emplacement would begin in 2010. One of five candidate rail corridors leading to the site could be selected in Nevada (Figure L-2). In the vicinity of the Yucca Mountain site the five rail corridors converge to two possible routes. Alternatively, if heavy-haul transport were selected, one intermodal transfer station and one associated route would be identified from the three potential intermodal transfer station locations and five potential routes for heavy-haul trucks (Figure L-3). In the vicinity of the Yucca Mountain site, the potential routes converge to two possible routes that may require upgrades. At greater distances, routes would utilize public roads and existing Nevada Test Site roads to the extent possible.

Some transportation-related actions associated with the DOE proposal would occur in floodplains on the proposed repository site on land the Federal government would manage. Route construction and operation could affect the 100-year and 500-year floodplains of Fortymile Wash, Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash in the vicinity of the Yucca Mountain site. This assessment examines the potential floodplain impacts to all four washes although all four might not be affected. The

effects on floodplains and areas that may contain wetlands elsewhere in Nevada along the five rail corridors and at the three intermodal station locations associated with heavy-haul transport are examined using available information. When DOE makes a decision whether to use rail or heavy-haul transport, more information would be obtained to support further environmental review.

This section is divided into two parts. Section L.2.1 discusses the proposed action in the vicinity of the Yucca Mountain site including rail access; heavy-haul truck access; and potential construction of an associated rail line, bridge, and roads. Section L.2.2 discusses possible actions elsewhere in Nevada including rail access and intermodal transfer station locations.

L.2.1 PROPOSED ACTIONS AT YUCCA MOUNTAIN

The preliminary layout of surface facilities at the repository is shown on Figure L-1. Except for a possible rail line and roads, no facilities are generally anticipated to be located within either the 100-year or 500-year floodplains of Fortymile Wash, Busted Butte Wash, Drill Hole Wash, or Midway Valley Wash. The paragraphs below describe the rail line and roads that could affect the floodplains of these washes in the vicinity of the Yucca Mountain site.

DOE has used other flood estimating techniques to evaluate the Proposed Action at Yucca Mountain. As described in Section L.1 and shown in Figure L-1, the U.S. Geological Survey performed the flood study at Fortymile Wash and its principal tributaries that forms the basis for the 100- and 500- year flood inundation levels evaluated in this EIS. DOE used another estimating method, the *probable maximum flood* value methodology [based on American National Standards Institute and American Nuclear Society Standards for Nuclear Facilities (DIRS 103071-ANS 1992, all)], to generate maximum flood values for specific segments of washes adjacent to planned Yucca Mountain facilities (DIRS 100530-Blanton 1992, all; DIRS 108883-Bullard 1992, all). The probable maximum flood methodology is a very conservative approach intended to generate the most severe flood value reasonably possible for the location under evaluation, and is larger than any of the other flood values estimated for the site. None of the flood estimates, including those generated for a probable maximum flood, predict water levels high enough to reach the portal entrances to the subsurface facilities. Both the north and south portal entrances to the subsurface facilities were located to be above the probable maximum flood event. However, some of the surface support facilities outside the north portal (in addition to a possible rail line and roads), would be within the level of the probable maximum flood (DIRS 102215-YMP 1995, p. 2-12). DOE would design surface facilities where it would manage radiological materials to ensure their protection against this most severe flood level. The probable maximum flood approach is the method most in use around the world in hydrologic designs for structures critical to public safety, and is required for the design of dam spillways, large detention basins, major bridges, and nuclear facilities.

L.2.1.1 Rail Access

At this time, there is no rail access to the Yucca Mountain site. DOE has identified five candidate rail corridors in Nevada for transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain.

If DOE selected a rail corridor leading to the Yucca Mountain site from the west and south (either the Carlin or Caliente Corridors), the rail line could cross Busted Butte Wash, Drill Hole Wash just west of its confluence with Fortymile Wash, and Midway Valley Wash (Figure L-1). Cut, fill, drainage culverts or bridges could be used to cross Busted Butte, Drill Hole, and Midway Valley washes. The widths of Busted Butte Wash and Drill Hole Wash (including their floodplains) are about 150 meters (500 feet) each where they would be crossed by the rail line. The width of Midway Valley Wash (including its floodplain) is about 300 meters (1,000 feet) where it could be crossed by the rail line.

If DOE selected a rail corridor leading to the Yucca Mountain site from the east (Caliente-Chalk Mountain, Jean, or Valley-Modified corridors) the rail line could cross approximately 400 meters (1,300 feet) of Fortymile Wash and its associated floodplains. In this case, the rail line could cross the wash on either a bridge (with supports located in the wash) or on a raised rail line that could be constructed in the wash (with appropriately-sized drainage culverts). After crossing Fortymile Wash, the rail line could continue along the east side of Yucca Mountain and cross about 300 meters (1,000 feet) of Midway Valley Wash before arriving at the repository.

L.2.1.2 Heavy-Haul Truck Access

DOE has identified five candidate routes for heavy-haul trucks in Nevada for transporting spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site.

If DOE selected a route leading to the Yucca Mountain site from the west and south, the route could cross Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash (Figure L-1). Cut, fill, drainage culverts or bridges could be used to cross Busted Butte, Drill Hole, and Midway Valley washes.

If DOE selected a route leading to the Yucca Mountain site from the east, the route could cross Fortymile Wash. The route could either cross through the wash or a bridge could be constructed over it. After crossing Fortymile Wash, the route could continue along the east side of Yucca Mountain and could cross Midway Valley Wash before arriving at the repository.

During potential repository operation, some spent nuclear fuel and high-level radioactive waste would be transported to the Yucca Mountain site by legal-weight trucks. These trucks could access Yucca Mountain from the east by crossing Fortymile Wash along the existing road or access Yucca Mountain along the route used by heavy-haul trucks. The legal-weight trucks could then proceed along the east side of Yucca Mountain and cross Midway Valley Wash along the route.

L.2.1.3 Construction

Construction of a candidate rail line near Yucca Mountain as well as upgrading the existing roads for heavy-haul and legal-weight trucks and for access to site facilities in the vicinity would take about 1 year to complete. Existing site roads would be upgraded as needed to provide access between site facilities, including ventilation shafts that would be located to the west of the portal areas. In some cases, new road segments would be necessary to provide the access. The site access roads could go through drainage channels, primarily upper portions of Drill Hole Wash and one of its tributaries to the south (see Figure L-1). Standard construction practices would be used, including the use of explosives and heavy earth-moving equipment. Standard measures would also be used to minimize erosion. Petroleum fuels, oils, lubricants and other hazardous materials would be used during construction, although these materials would be stored outside the 500-year floodplain.

Construction aggregate could be obtained from local borrow pits, but rail-bed ballast would need to be obtained from outside sources. Concrete would be obtained from a nearby concrete batch plant or from a new batch plant that may be built closer to the repository site. Neither the borrow pits nor the concrete batch plant would be located in a floodplain or wetlands. Rock excavated from the subsurface would be stockpiled in the area between the North and South Portals, just south of the primary channel of Drill Hole Wash. The stockpiled rock would be in the area of 100 and 500 year flood zones for a southern tributary to Drill Hole Wash (see Figure L-1).

If DOE decided to build a bridge at the 300- to 450-meter (1,000- to 1,500-foot)-wide Fortymile Wash, it would perform a flood design analysis to determine the optimum span of the structure. Supports for the bridge would be constructed in the floodplain of the wash. If a rail line were constructed across the

bottom of Fortymile Wash, extensive earthwork (cut and fill) would be required to maintain the less-than-2-percent grade required for the rail alignment.

L.2.2 POSSIBLE ACTIONS ELSEWHERE IN NEVADA

At this time there is no rail access to Yucca Mountain. This means that material traveling by rail would have to continue to the repository on a new branch rail line or transfer to heavy-haul trucks at an intermodal transfer station in Nevada and then travel on existing highways. DOE is considering construction of *either* a new branch rail line *or* an intermodal transfer station and associated highway improvements. The DOE has identified five candidate rail corridors, each of which has alignment variations (Figure L-2), and three possible locations for an intermodal transfer station associated with heavy-haul trucks (Figure L-3).

For analytical purposes, it is assumed that construction of a rail line in Nevada would take between 40 and 46 months. If a decision were made to proceed with development of a repository, it is likely that the DOE would decide at that time whether to build a rail line or to develop an intermodal transfer station site for heavy-haul waste transport. Should DOE decide to construct a rail line, standard practices for construction of rail lines would be used, including minimizing steep grades, utilizing cut and fill earthwork techniques, and crossing flood-prone areas using culverts or bridges. With respect to flood-prone areas, DOE would generally design rail line features to accommodate 100-year flood levels. However, the final design would be in accordance with standard engineering practices and judgment and economic analysis. The design process would consider a range of flood frequencies and include a cost benefit analysis in the selection of a design frequency (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.c). Should DOE decide to use a route for heavy-haul trucks, portions of the existing roads used for heavy-haul transport may require upgrades to accommodate the heavy loads.

L.3 Existing Environment

L.3.1 EXISTING ENVIRONMENT AT YUCCA MOUNTAIN

Fortymile Wash is about 150 kilometers (93 miles) long and drains an area of about 810 square kilometers (310 square miles) to the east and north of Yucca Mountain (Figure L-1). The wash continues southward and connects to the Amargosa River. The Amargosa River drains an area of about 8,000 square kilometers (3,100 square miles) by the time it reaches Tecopa, California. The mostly-dry river bed extends another 100 kilometers (60 miles) before ending in Death Valley.

Busted Butte and Drill Hole washes drain the east side of Yucca Mountain and flow into Fortymile Wash (Figure L-1; Midway Valley Wash is a tributary to Drill Hole Wash). Busted Butte Wash drains an area of 17 square kilometers (6.6 square miles) and Drill Hole Wash drains an area of 40 square kilometers (15 square miles).

The existing environment at and near Yucca Mountain, including Fortymile Wash, Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash is described in Chapter 3 of the EIS. The information below summarizes several of the more important aspects of the environment that pertain to this floodplain assessment.

L.3.1.1 Flooding

Water flow in the four washes is rare. The arid climate and meager precipitation [about 10 to 25 centimeters (4 to 10 inches) per year at Yucca Mountain] result in quick percolation of surface water into the ground and rapid evaporation. Flash floods, however, can occur after unusually strong summer thunderstorms or during sustained winter precipitation. During these times, runoff from ridges,

pediments, and alluvial fans flows into the normally dry washes that are tributary to Fortymile Wash. Estimated peak discharges in Fortymile Wash are 340 cubic meters per second (12,000 cubic feet per second) for the 100-year flood and 1,600 cubic meters per second (58,000 cubic feet per second) for the 500-year flood. Estimated peak discharges in Busted Butte Wash are 40 cubic meters per second (1,400 cubic feet per second) for the 100-year flood and 180 cubic meters per second (6,500 cubic feet per second) for the 500-year flood. Estimated peak discharges in Drill Hole Wash are 65 cubic meters per second (2,300 cubic feet per second) for the 100-year flood and 280 cubic meters per second (10,000 cubic feet per second) for the 500-year flood.

The Nevada Test Site access road to Yucca Mountain crosses Fortymile Wash in the area where it joins Drill Hole Wash. The next nearest manmade structure within Fortymile Wash is U.S. Highway 95, more than 19 kilometers (12 miles) south of the confluence of Drill Hole and Fortymile washes. The portion of the community of Amargosa Valley that was once known as Lathrop Wells is the nearest population center to Yucca Mountain, about 22 kilometers (14 miles) to the south along U.S. 95 and 3.2 kilometers (2 miles) east of Fortymile Wash.

Flooding events in the region are often very localized. A flash flood in one or more of the washes draining to Fortymile Wash, for example, might not result in any notable flow in the much larger Fortymile Wash. In rare cases, however, storm and runoff conditions can be extensive enough to result in flow being present throughout the drainage system. DIRS 155679-Glancy and Beck (1998, all) documented conditions during March 1995 and February 1998 where Fortymile Wash and the Amargosa River flowed simultaneously through their primary channels to Death Valley. The 1995 incident represented the first documented case of this flow condition.

L.3.1.2 Wetlands

There are no springs, perennial streams, hydric soils, or naturally occurring wetlands at Yucca Mountain. There are two manmade well ponds within Fortymile Wash, and two east of that wash, that have riparian vegetation (DIRS 104592-CRWMS M&O 1999, pp. 5 to 6; DIRS 104593-CRWMS M&O 1999, p. 2-14).

L.3.1.3 Biology

Vegetation at and near Fortymile Wash is typical of the Mojave Desert. The mix or association of vegetation in Fortymile Wash, which is dominated by the shrubs white bursage (*Ambrosia dumosa*), creosotebush (*Larrea tridentata*), white burrobush (*Hymenoclea salsola*), and heathgoldenrod (*Ericameria paniculata*), differs somewhat from other vegetation association at Yucca Mountain (DIRS 104589-CRWMS M&O 1998, pp. 5 to 7). No plant species are known to be restricted to the floodplains. In addition, none of the more than 180 plant species known to occur at Yucca Mountain is endemic to the area.

None of the 36 mammal, 27 reptile, or 120 bird species that have been documented at Yucca Mountain are restricted to or dependent on the floodplain. These species all are widespread throughout the region. No amphibians have been found at Yucca Mountain.

The only plant or animal species that has been found at Yucca Mountain that is classified as threatened, endangered, or proposed under the Endangered Species Act is the desert tortoise (*Gopherus agassizii*) which is classified as threatened. Yucca Mountain is at the northern edge of the range of the desert tortoise (DIRS 101915-Rautenstrauch, Brown, and Goodwin 1994, p. 11). Desert tortoises are known to occur within the floodplain of Fortymile Wash, but their abundance there and elsewhere at Yucca Mountain is low compared to other parts of its range farther south and east (DIRS 102869-CRWMS M&O 1997, pp. 6 to 11). Information on the ecology of the desert tortoise population at Yucca Mountain is summarized in DIRS 104593-CRWMS M&O (1999, p. 2-8).

Four species classified as sensitive by the Bureau of Land Management occur at Yucca Mountain: two species of bats [the long-legged myotis (*Myotis volans*) and the fringed myotis (*Myotis thysanodes*)] (DIRS 104590-CRWMS M&O 1998, p. 11), the western chuckwalla (*Sauromalus obesus obesus*) (DIRS 103159-CRWMS M&O 1998, pp. 22 to 23), and the western burrowing owl (*Speotyto cunicularia hypugaea*) (DIRS 103654-Steen et al. 1997, pp. 19 to 29). These species may occur within the floodplain of Fortymile Wash, but they are not dependent upon habitat there (DIRS 104590-CRWMS M&O 1998, p. 8; DIRS 103159-CRWMS M&O 1998, pp. 22 to 23; DIRS 103654-Steen et al. 1997, pp. 19 to 29).

L.3.1.4 Archaeology

Archaeological surveys have been conducted in Fortymile Wash east of Yucca Mountain. Fortymile Wash was an important crossroad where several trails converged from such distant places as Owens Valley, Death Valley, and the Avawtz Mountains.

L.3.2 EXISTING ENVIRONMENT ELSEWHERE IN NEVADA

The following sections describe the environment along each of the five candidate rail corridors (Figure L-2) and at the three intermodal transfer station locations (Figure L-3). The corridors are about 0.4 kilometer (0.25 mile) wide, and the length of each corridor varies (Table L-1). Table L-2 lists surface-water-related resources along each of the five rail corridors. Table L-3 lists similar information for the corridor variations. The last column of Table L-2 identifies water resources that DOE would avoid by using a specified variation rather than the corresponding section of the corridor. Water resources along the variation that would be "substituted" can be linked from Table L-3. If the same water resource would be close to both the corridor and its variation, it is listed as "Avoided" in Table L-2, but appears in Table L-3 for the variation. Details of each of the corridors and surface-water-related resources are found in DIRS 104593-CRWMS M&O (1999, Appendixes E, F, G, H, and I).

Table L-1. Length of each rail corridor implementing alternative.

Rail corridor	Length	Range with variations
Caliente	513 kilometers (319 miles)	512 to 853 kilometers (318 to 344 miles)
Carlin	520 kilometers (323 miles)	414 to 544 kilometers (257 to 338 miles)
Caliente-Chalk Mountain	345 kilometers (214 miles)	344 to 382 kilometers (214 to 237 miles)
Jean	181 kilometers (112 miles)	181 to 204 kilometers (112 to 127 miles)
Valley Modified	159 kilometers (98 miles)	159 to 163 kilometers (99 to 101 miles)

Table L-4 lists identified 100-year flood zones associated with each rail corridor. The information in this table is from Flood Insurance Rate Maps published by the Federal Emergency Management Agency for Clark, Eureka, Lander, Lincoln, and Nye Counties, Nevada. DOE plotted positions of the rail corridors on the flood maps noting the 100-year flood zones intersected by the corridor centerline and scaling crossing distances. In many cases a single entry in the table represents more than one flood zone encountered in the same general area (for example, in an area of converging drainage channels). As appropriate, the description in the table under the Flood Zone Feature column identifies the inclusion of more than one zone. The last column of Table L-4 identifies if one of the variations along the corridor avoids the specific feature. If it can be avoided (as indicated by a Yes or "Y" in the column), a designation refers to the variation listing in Table L-5. As applicable, the variations in Table L-5 list the flood zones they would cross. In some cases, a flood zone avoided along the corridor would still be crossed at a different location by a variation, and appears on both tables. As indicated in a footnote to Table L-4, the Federal Emergency Management Agency has not published flood maps for all the areas crossed by the rail corridors; the table lists an estimate of the amount of each corridor that is not covered. It does not list Fortymile Wash and other drainage channels near the site of the proposed repository,

Table L-2. Surface-water-related resources along candidate rail corridors[a] (page 1 of 2).

Rail corridor	Distance from corridor (kilometers)[b]	Feature	Avoided by variation[c] (Yes or No)
Caliente, Eccles Option			
Eccles Siding to Meadow Valley Wash	Within	Riparian area/stream – corridor crosses and is adjacent to stream and riparian area in Meadow Valley Wash	Y-1, 2
Meadow Valley to Sand Spring Valley	1.0	Spring – Bennett Spring, 3.2 kilometers southeast of Bennett Pass	N
	0.05 - 2.6	Springs – group of five springs (Deadman, Coal, Black Rock, Hamilton, and one unnamed) east of White River	N
	Within	Riparian/river – corridor parallels (and crosses) the White River for about 10 kilometers. August 1997 survey found river to be mostly underground with ephemeral washes above ground.	N
	0.8	Spring – McCutchen Spring, north of Worthington Mountains	N
Sand Spring Valley to Mud Lake	0.02	Spring – Black Spring, south of Warm Springs	N
Mud Lake to Yucca Mountain	Within - 2.5	Springs – numerous springs and seeps along Amargosa River in Oasis Valley	Y-8
	Within - 0.3	Riparian Area/stream – designated area east of Oasis Valley, flowing into Amargosa River, also riparian area, with persistent water and extensive wet meadows near springs and seeps	Y-8
	0.3 - 1.3	Springs – group of 13 unnamed springs in Oasis Valley north of Beatty	Y-8
Carlin, Big Smoky Valley Option			
Beowawe *to Austin*	0.5	Spring – Tub Spring, northeast of Red Mountain	Y-11
	0.8	Spring – Red Mountain Spring, east of Red Mountain	Y-11
	0.9	Spring – Summit Spring, west of corridor and south of Red Mountain	N
	0.4	Spring – Dry Canyon Spring, west of Hot Springs Point	N
	0.8	Spring – unnamed spring on eastern slope of Toiyabe Range, southwest of Hot Springs Point	N
	1.0	Riparian area – intermittent riparian area associated with Rosebush Creek, in western Grass Valley, north of Mount Callaghan	Y-12
	Within	Riparian/creek – corridor crosses Skull Creek, portions of which have been designated riparian areas	Y-12
	Within	Riparian/creek – corridor crosses intermittent Ox Corral Creek; portions designated as riparian habitat. August, 1997 survey found creek dry with no riparian vegetation present	Y-12

Table L-2. Surface-water-related resources along candidate rail corridors[a] (page 2 of 2).

Rail corridor	Distance from corridor (kilometers)[b]	Feature	Avoided by variation[c] (Yes or No)
Beowawe to Austin (continued)	0.1	Spring – Rye Patch Spring, at north entrance of Rye Patch Canyon, west of Bates Mountain	N
	Within	Riparian area – corridor crosses and parallels riparian area in Rye Patch Canyon	Y-13
	0.7	Spring – Bullrush Spring, east of Rye Patch Canyon	N
Austin to Mud Lake	0.8	Springs – group of 35 unnamed springs, about 25 kilometers north of Round Mountain on east side of Big Smokey Valley	Y-14
	0.6	Riparian area – marsh area formed from group of 35 springs	Y-14
	0.6	Spring – Mustang Spring, south of Seyler Reservoir	Y-14
	0.3	Riparian/reservoir – Seyler Reservoir (seasonal), west of Manhattan	Y-14
Mud Lake to Yucca Mountain		See Caliente Corridor	
Caliente-Chalk Mountain			
Eccles Siding to Meadow Valley		See Caliente Corridor	
Meadow Valley to Sand Spring Valley		See Caliente Corridor	
Sand Spring Valley to Yucca Mountain	1.0	Spring – Reitman's Seep, in eastern Yucca Flat, east of BJ Wye	Y-15, 16
	0.3	Spring – Cane Spring, on north side of Skull Mountain on Nevada Test Site	Y-15
Jean, Wilson Pass Option		None identified	
Valley Modified		None identified	

a. Source: DIRS 104593-CRWMS M&O (1999, Appendixes E, F, G, H, and I).
b. To convert kilometers to miles, multiply by 0.62137.
c. Certain water resources would be avoided by variations. These are identified with a "Y" (yes) and a number representing the specific variation from Table L-3 that avoids the specific resource. Table L-3 identifies the variation by number and shows the water resources associated with each. The same water resource may be in proximity to both the corridor and variation. In such cases, the resource is marked "Avoided" for the corridor here, but will appear on Table L-3 for the variation.

discussed earlier in this document. This is because those washes near the proposed repository site are on the Nevada Test Site, one of the areas not covered by published flood maps.

More detail on each of the rail corridors is provided in Chapter 2, Section 2.1.3.3.2, and Chapter 3, Section 3.2.2. Chapter 6, Section 6.3.2, describes the potential impacts of rail implementing alternatives and Chapter 6, Section 6.3.3 describes the potential impacts of the construction and use of intermodal transfer stations under the heavy-haul truck implementing alternatives.

L.3.2.1 Caliente Corridor

Flooding: The Caliente Corridor, Eccles Option, crosses 352 washes en route to the Yucca Mountain site (DIRS 154961-CRWMS M&O 1998, all). Approximately 12 washes along this route are large enough that bridges would be required to cross them. Based on available Federal Emergency Management Agency flood maps, this corridor would cross nine different 100-year flood zones or flood-zone groups (see Table L-4) between its beginning near Caliente and when it enters the Nevada Test Site. None of the variations applicable to this corridor (Table L-5) would change this number notably. Use of the Crestline

Table L-3. Surface-water-related resources along variations for the rail corridors[a,b] (page 1 of 2).

Variation	Applicable corridor(s)[c]	Distance from corridor (kilometers)[d]	Description
1. Crestline Option	CL/CM	0.3	Spring - Miller Spring south of SR 319 and southeast of Panaca; important water source of game
		1.0	Spring - Miser Spring south of SR 319 and southeast of Panaca
		In	Riparian area/stream - variation crosses Meadow Valley Wash stream and riparian area south of Panaca
2. Caliente Option	CL/CM	In	Riparian area/stream - variation crosses Meadow Valley Wash stream and riparian area south of Caliente
		0.6	Spring - unnamed spring in Caliente
		In	Spring - unnamed spring in Meadow Valley north of Caliente
		0.5	Springs - two unnamed springs in Meadow Valley north of Caliente
3. White River Alternate	CL/CM		None identified - parallels White River further than rail corridor, but not within 1 kilometer
4. Garden Valley Alternate	CL/CM		None identified
5. Mud Lake Alternate	CL/CR		None identified
6. Goldfield Alternate	CL/CR	0.6	Spring - Tognoni Springs northeast of Goldfield
		0.4	Spring - unnamed spring south of Mud Lake and east of U.S. 95
7. Bonnie Claire Alternate	CL/CR		None identified
8. Oasis Valley Alternate	CL/CR	0.5 - 3.0	Springs - numerous springs and seeps along Amargosa River in Oasis Valley
		In - 0.3	Riparian area - designated area east of Oasis Valley, flowing into Amargosa River, also a riparian area, with persistent water and extensive wet meadows near springs and seeps
		0.8 - 1.8	Springs - group of 13 unnamed springs in Oasis Valley north of Beatty
9. Beatty Wash Alternate	CL/CR		None identified
10. Crescent Valley Alternate	CR		None identified
11. Wood Spring Canyon Alternate	CR		None identified
12. Steiner Creek Alternate	CR	In	Riparian area - variation crosses designated riparian area in Water Canyon northeast of Bates Mountain
		In	Riparian/creek - variation crosses Steiner Creek, a designated riparian area. An August 1997 survey found creek dry and lacking riparian vegetation.
13. Rye Patch Alternate	CR	0.1	Riparian area - variation parallels riparian area in Rye Patch Canyon Spring - Bull rush Spring, east of Rye Patch Canyon

Table L-3. Surface-water-related resources along variations for the rail corridors[a,b] (page 2 of 2).

Variation	Applicable corridor(s)[c]	Distance from corridor (kilometers)[d]	Description
14. Monitor Valley Option	CR	0.7	Spring - unnamed spring east of variation and east of Toquima Range
		0.2	Riparian area - designated riparian area west of variation, northwest of Belmont. An August 1997 survey found area dry and lacking riparian vegetation.
15. Topopah Option	CM	0.6	Spring – Whiterock Spring north of variation, south of Burnt Mountain
15a. Area 4 Alternate	CM		None identified – avoids Whiterock Spring of the Topopah Option
15b. Mine Mountain Alternate	CM		None identified – main portion of option still passes Whiterock Spring
16. Mercury Highway Option	CM		None identified
17. Pahrump Valley Alternate	J		None identified
18. Stateline Pass Option	J		None identified
19. Valley Connection	VM		None identified
20. Sheep Mountain Alternate	VM		None identified
21. Indian Hills Alternate	VM		None identified

a. Source: DIRS 104593-CRWMS M&O (1999, Appendixes E, F, G, H, and I).
b. Rail corridors are identified in Table L-2. Water resources identified in that table that can be avoided by a variation are identified with a number designation which is consistent with the numbering in this table.
c. Rail corridor abbreviations used in the table are defined as follows: CL = Caliente; CM = Caliente-Chalk Mountain; CR = Carlin; J = Jean; and VM = Valley Modified.
d. To convert kilometers to miles, multiply by 0.62137.

Option (number 1 in Table L-5) would decrease the number of flood zones crossed by one, and the other applicable variations would leave the number unchanged or increased by one. As noted in Table L-4, flood map coverage of the Lincoln County portion of this corridor is limited. Additional floodplain definition has not occurred.

Wetlands: At least four springs or groups of springs and three streams or riparian areas that may have associated wetlands are within 0.4 kilometer (0.25 mile) of the Caliente Corridor. However, no field searches or formal delineations of wetlands have been conducted along this route. Black Spring is near the corridor at the north end of the Kawich Range and an unnamed spring is near the corridor at the north end of the North Pahroc Range. A group of springs is in the corridor near the Amargosa River in Oasis Valley. The corridor crosses the Meadow Valley Wash south of Panaca. The corridor also crosses the White River between U.S. Highway 93 and Sand Spring Valley and parallels the river for approximately 10 kilometers (6 miles). That portion of the White River normally is dry. The corridor crosses the Amargosa River in the north end of the Oasis Valley, in an area designated as riparian area by the Bureau of Land Management (DIRS 104593-CRWMS M&O 1999, p. 3-23). Four of the variation segments (Crestline Option, Caliente Option, Goldfield Alternate, and Oasis Valley Alternate) along the Caliente Corridor would affect the number of, or distance to, associated water resources. Using the Crestline Option, Caliente Option, or Goldfield Alternate would add one spring within 0.4 kilometer (0.25 mile) of the corridor. The Oasis Valley Alternate is close to the same water resources as the corresponding portion of the Caliente Corridor, but it would be farther from two groups of springs near the Amargosa River.

Biology: The desert tortoise is the only threatened or endangered species found along the Caliente Corridor. The southern 50 kilometers (30 miles) of this corridor is within desert tortoise habitat. This area is not designated as critical habitat and the abundance of tortoises in the area is low (DIRS 104593-CRWMS M&O 1999, p. 3-23). Southwestern willow flycatchers (*Empidonax traillii extimus*), an

Table L-4. 100-year flood zones crossed by candidate rail corridors[a] (page 1 of 2).

Rail corridor and segment[b]	Crossing distance (kilometers)[c]	Flood zone feature(s)	Avoided by variation[d] (Yes or No)
Caliente, Eccles Option			
Eccles Siding to Meadow Valley Wash	0.2[e]	Clover Creek (intermittent)	Y-1
	0.8[e]	Meadow Valley Wash (wet)	Y-1,2
Meadow Valley Wash to Sand Spring Valley	0.5[e]	White River (intermittent)	N
Sand Spring Valley to Mud Lake	1.1	Unnamed drainage gully in East/Central Nye County; crosses twice (dry)	N
	17.5	Mud Lake basin and drainage tributaries (normally dry)	N
Mud Lake to Yucca	0.8	Unnamed washes to the north and south of Ralston (dry)	N
Mountain	0.3	Tolicha Wash	Y-7
	1.1	Amargosa River (wet in sections, intermittent in others)	Y-8
	0.1	Beatty Wash	Y-9
Carlin, Big Smoky Valley Option			
Beowawe to Austin	4.0	Flood zone associated with Coyote Creek drainage (dry)	N
	1.6	Indian Creek (dry) and unnamed wash to the south	Y-10
	0.9	Unnamed Callaghan tributary, Skull and Callaghan Creeks (intermittent)	Y-12
	0.1	Rye Patch Canyon Creek (intermittent)	Y-13,14
	1.4	Simpson Park Canyon Creek (intermittent) and Canyon Creek drainage (intermittent)	Y-13,14
	1.4	Canyon Creek and Canyon Creek drainage (intermittent)	Y-14
Austin to Mud Lake	0.3	Peavine Creek tributary (intermittent)	Y-14
Mud Lake to Yucca Mountain		See Caliente Corridor	
Caliente-Chalk Mountain			
Eccles Siding to Meadow Valley to Sand Spring Valley		See Caliente Corridor	
Sand Spring Valley to Yucca Mountain	--[f]	Not available	
Jean,[d] Wilson Pass Option			
Jean to Yucca Mountain	0.6	Three tributaries leading to Roach Lake (intermittent)	Y-18
	0.7	Lovell Wash with drainage (intermittent)	Y-18
	0.4	Two unnamed washes northwest of Lovell Wash	N
	4.1	Peak Springs Alluvial Fan (dry)	N
	1.9	Wheeler Wash (dry)	N
	0.3	Wash drainage leading to Alkali Flats (dry)	N
	0.1	Rock Valley Wash (intermittent)	N

Table L-4. 100-year flood zones crossed by candidate rail corridors[a] (page 2 of 2).

Rail corridor and segment[b]	Crossing distance (kilometers)[c]	Flood zone feature(s)	Avoided by variation[d] (Yes or No)
Valley Modified			
Dry Lake to Yucca Mountain	0.1[f]	Unnamed creek northwest of the City of Las Vegas (intermittent)	N
	1.2[e]	Drainage (projected) west of Indian Springs Air Force Auxiliary Base (intermittent)	Y-21

a. Sources:
   1. Federal Emergency Management Agency Flood Insurance Rate Maps for Clark, Eureka, Lander, Lincoln, and Nye Counties, Nevada.
   2. DIRS 154961-CRWMS M&O (1998, all).
b. Percentage of missing rail corridor information.
   1. *Caliente* - About 47 percent not available on Federal Emergency Management Agency maps, mostly due to limited coverage in Lincoln County and the Nevada Test Site.
   2. *Carlin* - About 17 percent is not available on Federal Emergency Management Agency maps, mostly due to limited coverage in Esmeralda County and Nevada Test Site.
   3. *Caliente-Chalk Mountain* – About 91 percent is not available on Federal Emergency Management Agency maps, mostly due to limited coverage in Lincoln County, the Nellis Air Force Range, and the Nevada Test Site.
   4. *Jean* - About 10 percent is not available on Federal Emergency Management Agency maps due to the portion of the route in the Nevada Test Site.
   5. *Valley Modified* - Approximately 25 percent is not available on Federal Emergency Management Agency maps due to the portion of the route in the Nellis Air Force Range, and the Nevada Test Site.
c. To convert kilometers to miles, multiply by 0.62137.
d. Certain 100-year flood zones can be avoided by corridor variations. These are identified with a "Y" (yes) and a number representing the specific variation(s) from Table L-5 that avoids the specific flood zone. The same flood zone may be crossed by both the rail corridor and a variation at different locations. In such cases, the feature will be marked "Avoided" for the rail corridor here, but will appear again on Table L-5 for the variation.
e. Projected from limited data. Specific area not covered by Federal Emergency Management Agency maps; values were extrapolated from the closest maps.
f. Limited information due to the Nevada Test Site and/or the Nellis Air Force Range.

endangered species, have been observed in dense stands of riparian vegetation in Lincoln County, but there is no suitable habitat for this species in the corridor (DIRS 152511-Brocoum 2000, pp. A-9 to A-13). Three other species (Meadow Valley Wash speckled dace [*Rhinichthys osculus* ssp.], Meadow Valley Wash desert sucker [*Catostomus clarki* ssp.], and Nevada sanddune beardtongue) classified as sensitive by the Bureau of Land Management or as protected by Nevada have been found along the Caliente Corridor. This rail corridor crosses approximately 14 areas designated as game habitat and one area classified as waterfowl habitat (DIRS 104593-CRWMS M&O 1999, p. 3-23). Two of these species, the speckled dace and desert sucker, are restricted to the floodplain of the Meadow Valley Wash. The designated waterfowl habitat also is generally restricted to the floodplain of Meadow Valley Wash and adjacent wetlands.

Archaeology: There are 97 archaeological sites that have been recorded along the Caliente Corridor (DIRS 104997-CRWMS M&O 1999, Table 3, p. 59).

L.3.2.2 Carlin Corridor

Flooding: The Carlin Corridor, Big Smoky Valley Option, crosses 273 washes en route to the Yucca Mountain site (DIRS 154961-CRWMS M&O 1998, all). Approximately 10 washes along this route are large enough that bridges would be required to cross them. According to the Federal Emergency Management Agency flood map data summarized in Table L-4, this corridor would cross 11 different 100-year flood zones or flood zone groups before entering the Nevada Test Site. Eight of the 10 variations applicable to this corridor (see Table L-5) would change the number of flood zones crossed, but with one exception, changes would be up or down by only one. The exception would be the Monitor

Table L-5. 100-year flood zones crossed by unique segments of corridor variations[a,b] (page 1 of 2).

Variation	Corridor(s)[c]	Crossing distance (kilometers)[d]	Flood zone feature(s)
1. Crestline Option	CL/CM	0.8	Crosses Meadow Valley Wash (wet)
2. Caliente Option	CL/CM	0.8	Crosses Meadow Valley Wash (wet)
		0.2	Crosses Clover Creek (intermittent)
		0.9	Crosses Meadow Valley Wash (wet) three times, runs adjacent to Meadow Valley Wash, passes in and out of flood zone
3. White River Alternate	CL/CM	None	North of the unvaried corridor
4. Garden Valley Alternate	CL/CM	None	North of the unvaried corridor
5. Mud Lake Alternate	CL/CR	3.1	Crosses a larger amount of the Mud Lake flood zone (3.1 kilometers versus 1.8 kilometers for the unvaried corridor section)
6. Goldfield Alternate	CL/CR	None	West of unvaried corridor
7. Bonnie Claire Alternate	CL/CR	1.3	Crosses an unnamed wash south of Ralston
		0.7	Crosses Tolicha Wash (intermittent)
8. Oasis Valley Alternate	CL/CR	1.0	Crosses Amargosa River (wet in segments, intermittent in others)
9. Beatty Wash Alternate	CL/CR	0.1	Crosses Beatty Wash (intermittent)
10. Crescent Valley Alternate	CR	2.0	Crosses Indian Creek (intermittent)
		3.2	Crosses an unnamed wash to the south
11. Wood Spring Canyon Alternate	CR	None	West of the unvaried corridor
12. Steiner Creek Alternate	CR	4.9	Crosses Callaghan and Canyon Creeks (intermittent)
13. Rye Patch Alternate	CR	1.4	Crosses Canyon Creek and Canyon Creek drainage (intermittent)
14. Monitor Valley Option[e]	CR	0.6	Crosses Mosquito Creek (intermittent)
		0.5	Crosses Corcoran Creek and Meadow Creek (intermittent)
		1.5	Crosses Meadow Creek drainage (dry)
		0.6	Crosses Hunts Canyon Creek (intermittent)
		0.2	Crosses Willow Creek (intermittent)
		2.0	Crosses drainage areas approaching Mud Lake (dry)
		5.7	Crosses drainage areas approaching Mud Lake (dry)
		4.8	Crosses Mud Lake drainage (dry)
15. Topopah Option	CM	--[f]	Adjacent to Caliente-Chalk Mountain Corridor
16. Mercury Highway Option	CM	--[f]	Adjacent to Caliente-Chalk Mountain Corridor
17. Pahrump Valley Alternate	J	None	Northeast of unvaried corridor
18. Stateline Pass Option	J	0.4	Crosses two tributaries to Roach Lake (dry)
		0.8	Crosses Potasi Wash, an unnamed wash and Lovell Wash drainage
		1.1	Crosses four unnamed washes and Peak Springs Fan (intermittent)

Table L-5. 100-year flood zones crossed by unique segments of corridor variations[a,b] (page 2 of 2).

	Variation	Corridor(s)[c]	Crossing distance (kilometers)[d]	Flood zone feature(s)
19.	Valley Connection	VM	None	At the origin of the rail corridor
20.	Sheep Mountain Alternate	VM	None	North of the rail corridor
21.	Indian Hills Alternate	VM	None	South of the rail corridor

a. Sources:
   1. Federal Emergency Management Agency Flood Insurance Rate Maps for Clark, Eureka, Lander, Lincoln, and Nye Counties, Nevada.
   2. DIRS 154961-CRWMS M&O (1998, all).
b. Rail corridors are identified in Table L-4. Flood zones identified in that table that can be avoided by a variation are identified with a number designation that is consistent with the numbering in this table.
c. Rail corridor abbreviations: CL = Caliente; CM = Caliente-Chalk Mountain; CR = Carlin; J = Jean; VM = Valley Modified.
d. To convert kilometers to miles, multiply by 0.62137.
e. The Monitor Valley Option and the Goldfield Connector were combined since the flood zone crossings were approximately the same distances and the final flood zone crossing distance percentages are 8 percent for all Monitor Valley variations.
f. No information available on Federal Emergency Management Agency maps.

Valley Option (number 14 in Table L-5) which would increase the number of 100-year flood zones crossed by four. Table L-4 lists more 100-year flood zones for the Carlin Corridor than for any of the other corridors. This might be due, in part, to the fact that a large portion of the Carlin Corridor is covered by flood maps. Additional floodplain definition has not occurred.

Wetlands: There are at least three springs or groups of springs, four streams designated as riparian areas by the Bureau of Land Management, and one reservoir that may have associated wetlands within 0.4 kilometer (0.25 mile) of the Carlin Corridor. However, no field searches or formal delineations of wetlands have been conducted along this route. Rye Patch Spring is on the edge of the corridor at the south end of the Simpson Park Mountains, and a group of springs is in the corridor near the Amargosa River in Oasis Valley. Seyler Reservoir is less than 0.3 kilometer (0.2 mile) from the corridor in the south end of Big Smoky Valley. There are three riparian areas (Skull and Ox Corral creeks, and Rye Patch Canyon) along the section of the route between Beowawe and Austin at the south end of Grass Valley. Ox Corral creek, at the south end of Grass Valley, is ephemeral and has little or no riparian vegetation where the route crosses it. The corridor crosses the Amargosa River in the northern Oasis Valley, in an area designated as a riparian area by the Bureau of Land Management (DIRS 104593-CRWMS M&O 1999, pp. 3-25 to 3-26). Five of the variations (Oasis Valley, Steiner Creek, Rye Patch and Goldfield Alternates, and Monitor Valley Option) would affect the number of, or distance to, water resources along the Carlin Corridor. Changes associated with the Oasis Valley and Goldfield Alternates are covered above in the Caliente Corridor discussion. The Rye Patch Alternate would involve no changes to water resources in, or within 0.4 kilometer (0.25 mile) of, the Carlin Corridor, but would parallel the riparian area in Rye Patch Canyon rather than cross it. The Steiner Creek Alternate would avoid two riparian areas, but another two would be within this corridor variation. The Monitor Valley Option would represent a major change in the corridor but, with respect to water resources within 0.4 kilometer, it would avoid only Seyler Reservoir and would add a designated riparian area northwest of Belmont.

Biology: The desert tortoise is the only threatened or endangered species found along the Carlin Corridor. The southern 50 kilometers (30 miles) of this corridor is within desert tortoise habitat. This area is not designated as critical habitat and the abundance of tortoises in the area is low (DIRS 104593-CRWMS M&O 1999, p. 3-25). Three other species (ferruginous hawk [*Buteo regalis*], San Antonio pocket gopher [*Thomomys umbrinus curtatus*], and Nevada sand dune beardtongue [*Penstemom arenarius*]) classified as sensitive by the Bureau of Land Management or as protected by the State of Nevada have been found along the Carlin Corridor. Additionally, the rail corridor crosses approximately 7 areas designated as game habitat by the Bureau of Land Management (DIRS 104593-CRWMS M&O

1999, p. 3-25). None of these species or game habitats are restricted to floodplains or areas that may have wetlands.

Archaeology: There are 110 archaeological sites that have been recorded along the Carlin Corridor (DIRS 104997-CRWMS M&O 1999, Table 3, p. 59).

L.3.2.3 Caliente-Chalk Mountain Corridor

Flooding: The Caliente-Chalk Mountain Corridor crosses 281 washes en route to the Yucca Mountain site (DIRS 154961-CRWMS M&O 1998, all). Approximately five washes along this route are large enough that bridges would be required to cross them. Based on the Federal Emergency Management Agency flood map data summarized in Table L-4, this corridor would cross only three different 100-year flood zones or flood zone groups before entering the Nellis Air Force Range. Two of the four alternative segments applicable to this corridor (see Table L-5) would change the number of flood zones crossed, but changes would be up or down by only one. The low number of flood zones identified for the Caliente-Chalk Mountain Corridor should be qualified by the fact that a great majority of this corridor, as noted in Table L-4, is not covered by flood maps. This is due to limited coverage in Lincoln County and no coverage inside the Nellis Air Force Range and the Nevada Test Site. Additional floodplain definition has not occurred.

Wetlands: At least one spring or group of springs and two streams that may have associated wetlands occur within 0.4 kilometer (0.25 mile) of the Caliente-Chalk Mountain Corridor. However, no field searches or formal delineations of wetlands have been conducted along this route. An unnamed spring is near the corridor at the north end of the North Pahroc Range. The corridor crosses Meadow Valley Wash south of Panaca. The corridor crosses the White River between U.S. 93 and Sand Spring Valley and parallels the river for approximately 10 kilometers (6 miles). That portion of the White River normally is dry.

Biology: The desert tortoise is the only threatened or endangered species found along the Caliente-Chalk Mountain Corridor. The southern 40 kilometers (25 miles) of this corridor is within desert tortoise habitat. This area is not designated as critical habitat and the abundance of tortoises in the area is low (DIRS 104593-CRWMS M&O 1999, p. 3-27). Southwestern willow flycatchers, an endangered species, have been observed in dense stands of riparian vegetation in Lincoln County, but there is no suitable habitat for this species in the corridor (DIRS 152511-Brocoum 2000, pp. A-9 to A-13). Four species (Meadow Valley Wash speckled dace, Meadow Valley Wash desert sucker, Ripley's springparsley [*Cymopterus ripleyi* var. *saniculoides*], and largeflower suncup [*Camissonia megalantha*]) classified as sensitive by the Bureau of Land Management or protected by Nevada have been found in the Caliente-Chalk Mountain Corridor. This rail corridor crosses approximately six areas designated as game habitat and one area of waterfowl habitat (DIRS 104593-CRWMS M&O 1999, p. 3-27). Two of these sensitive species, the speckled dace and desert sucker, are restricted to the floodplain of the Meadow Valley Wash. The designated waterfowl habitat also is generally restricted to the floodplain of Meadow Valley Wash and adjacent wetlands.

Archaeology: There are 100 archaeological sites that have been recorded along the Caliente-Chalk Mountain route Corridor (DIRS 104997-CRWMS M&O 1999, Table 3, p. 59).

L.3.2.4 Jean Corridor

Flooding: The Jean Corridor, Wilson Pass Option, crosses 89 washes en route to the Yucca Mountain site (DIRS 154961-CRWMS M&O 1998, all). Approximately five washes along this route are large enough that bridges would be required to cross them. This corridor would cross seven different 100-year flood zones or flood zone groups (see Table L-4) before entering the Nevada Test Site. Use of the

Stateline Pass Option to this corridor (see Table L-5) would increase the number of flood zones crossed by one. Use of the Pahrump Valley Alternate would result in no change. Federal Emergency Management Agency flood map coverage of this corridor is the highest in terms of percentage of any of the rail corridors. Additional floodplain definition has not occurred.

Wetlands: No springs, perennial streams, or riparian areas that may have associated wetlands have been identified within 0.4 kilometer (0.25 mile) of the Jean Corridor or its variations (DIRS 104593-CRWMS M&O 1999, p. 3-29). However, no field searches or formal delineations of wetlands have been conducted along this route.

Biology: The desert tortoise is the only threatened or endangered species found along the Jean Corridor. This entire corridor, including its variations, is within desert tortoise habitat, but does not cross any areas designated as critical habitat. The abundance of desert tortoises is low along most of the rail corridor, although there is a higher abundance along some portions in Ivanpah, Goodsprings, Mesquite, and Pahrump valleys (DIRS 104593-CRWMS M&O 1999, p. 3-28). One species, the pinto beardtongue (*Penstemon bicolor* spp.) that is classified as sensitive by the Bureau of Land Management has been found within the corridor. This rail corridor crosses approximately 10 areas designated as game habitat by the Bureau of Land Management (DIRS 104593-CRWMS M&O 1999, p. 3-28). None of these species or game habitats are restricted to floodplains or areas that may have wetlands.

Archaeology: Six archaeological sites have been recorded along the Jean Corridor (DIRS 104997-CRWMS M&O 1999, Table 3, p. 59).

L.3.2.5 Valley Modified Corridor

Flooding: The Valley Modified Corridor crosses 95 washes en route to the Yucca Mountain site (DIRS 154961-CRWMS M&O 1999, pp. 3 to 4). Approximately three washes along this route are large enough that bridges would be required to cross them. Based on the Federal Emergency Management Agency flood map data summarized in Table L-4, this corridor would cross only two different 100-year flood zones or flood zone groups before entering the Nevada Test Site. Of the three variations to this corridor (see Table L-5), the Indian Hills Alternate (number 21 in Table L-5) would decrease the number of flood zones to one; the other two variations would have no change. Flood map coverage of the Valley Modified Corridor is relatively good at about 75 percent. Additional floodplain definition has not occurred.

Wetlands: No springs, perennial streams, or riparian areas that may have associated wetlands have been identified within 0.4 kilometer (0.25 mile) of the Valley Modified Corridor or its variations (DIRS 104593-CRWMS M&O 1999, pp. 3-29 to 3-30). However, no field searches or formal delineations have been conducted along this route.

Biology: The desert tortoise is the only threatened or endangered species found along the Valley Modified Corridor. This entire corridor, including its variations, is within desert tortoise habitat, but does not cross any areas designated as critical habitat. The abundance of desert tortoises is low along this rail corridor (DIRS 104593-CRWMS M&O 1999, p. 3-29). Two plant species (Parish's scorpionweed [*Phacelia parishii*] and Ripley's springparsley) classified as sensitive by the Bureau of Land Management have been found in the rail corridor. None of these species are restricted to floodplains or areas that may have wetlands. The Valley Modified Corridor does not cross any Bureau of Land Management-designated game habitat (DIRS 104593-CRWMS M&O 1999, p. 3-29).

Archaeology: Nineteen archaeological sites have been recorded along the Valley Modified Corridor (DIRS 104997-CRWMS M&O 1999, Table 3, p. 59).

L.3.2.6 Caliente Intermodal Transfer Station

Flooding: The two proposed sites for the Caliente intermodal transfer station are located in the Meadow Valley Wash south of Caliente. Both areas are outside the inundation boundary of the 100-year floodplain, but within the boundary of the 500-year floodplain.

Wetlands: Part of the proposed station location is moist during at least some portions of the year. There are no springs on the site; there are springs adjacent to the site and some areas within the site have soils and plant species indicative of wetlands. Many of these moist areas are believed to be the result of irrigation with treated effluent from the wastewater treatment facility within the site, but some might qualify as wetlands or other waters of the United States if they are the result of outflow from nearby springs or the adjacent Meadow Valley Wash. The adjacent perennial stream and riparian habitat along Meadow Valley Wash also might be classified as wetlands, although no formal delineation of wetlands has been conducted for this proposed activity (DIRS 104593-CRWMS M&O 1999, p. 3-35).

Biology: No game habitat, threatened or endangered species, or species classified as sensitive by the Bureau of Land Management or protected by Nevada occur within the proposed station location (DIRS 104593-CRWMS M&O 1999, p. 3-35). Although the Federally endangered Southwestern willow flycatcher has been detected in Meadow Valley Wash, there is no habitat for this species on this site (DIRS 152511-Brocoum 2000, pp. A-9 to A-13).

Archaeology: Four archaeological sites have been recorded at the Caliente intermodal transfer station site (DIRS 104997-CRWMS M&O 1999, Table 2, p. 32).

L.3.2.7 Apex/Dry Lake Intermodal Transfer Station

Flooding: The three proposed sites for the Apex/Dry Lake intermodal transfer station are outside the 100-year and 500-year floodplains.

Wetlands: There are no springs or riparian areas within the proposed station location (DIRS 104593-CRWMS M&O 1999, p. 3-36).

Biology: The only resident threatened or endangered species at this site is the desert tortoise. The abundance of desert tortoises in Dry Lake Valley generally is low, although some areas there have a higher abundance. One plant species, Geyer's milkvetch (*Astragalus geyeri triquetrus*), classified as sensitive by the Bureau of Land Management has been found in the proposed location. Neither of these species are restricted to floodplains or wetlands. No game habitat has been designated there (DIRS 104593-CRWMS M&O 1999, p. 3-36).

Archaeology: Two archaeological sites have been recorded at the Apex/Dry Lake intermodal transfer station site (DIRS 104997-CRWMS M&O 1999, Table 2, p. 32).

L.3.2.8 Sloan/Jean Intermodal Transfer Station

Flooding: The southernmost proposed site for the Sloan/Jean intermodal transfer station is located in the same general area as a 100-year flood inundation zone. The middle site is not in an inundation zone and is outside the 500-year floodplain. The northernmost proposed site is in an area with no printed Federal Emergency Management Agency map and it is outside the 500-year floodplain.

Wetlands: There are no springs or riparian areas within the proposed station location (DIRS 104593-CRWMS M&O 1999, p. 3-36).

Biology: The only resident threatened or endangered species at this site is the desert tortoise. The abundance of desert tortoises in Ivanpah Valley generally is moderate to high, relative to other areas within the range of this species in Nevada. One plant species, pinto beardtongue, classified as sensitive by the Bureau of Land Management has been found in the proposed location. Neither of these species are restricted to floodplains or wetlands. No game habitat has been designated there (DIRS 104593-CRWMS M&O 1999, pp. 3-36 to 3-37).

Archaeology: Seven archaeological sites have been recorded at the Sloan/Jean intermodal transfer station site (DIRS 104997-CRWMS M&O 1999, Table 2, p. 32).

L.4 Floodplain/Wetlands Effects

According to 10 CFR 1022.12(a)(2), a floodplain assessment is required to discuss the positive and negative, direct and indirect, and long- and short-term effects of the proposed action on the floodplain and/or wetlands. In addition, the effects on lives and property, and on natural and beneficial values of floodplains must be evaluated. For actions taken in wetlands, the assessment should evaluate the effects of the proposed action on the survival, quality, and natural and beneficial values of the wetlands. If DOE finds no practicable alternative to locating activities in floodplains or wetlands, DOE will design or modify its actions to minimize potential harm to or in the floodplains and wetlands. The floodplains that are assessed herein are those areas of normally dry washes that are temporarily and infrequently inundated from runoff during 100-year or 500-year floods.

L.4.1 FLOODPLAIN/WETLANDS EFFECTS NEAR YUCCA MOUNTAIN

DOE has not determined if rail casks will be transported in Nevada by heavy-haul trucks on existing highways or whether to construct a branch rail line to bring the spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site. Near Yucca Mountain, however, it is possible that each of the four washes could be affected if a rail line and a road were to access the Yucca Mountain site from different directions. Because of this uncertainty, this assessment examines the configurations that would cause the most disturbances to the four washes and their floodplains, as follows:

- Potential construction of a heavy-haul-capable road west of Fortymile Wash that crosses Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash. Cut, fill, and drainage culverts could be used to cross Busted Butte and Drill Hole washes. A bridge could be constructed over Midway Valley Wash. Heavy-haul trucks carrying spent nuclear fuel and high-level radioactive waste could travel along this road to the repository.

- Potential construction of a raised rail line through Fortymile Wash with appropriately-sized drainage culverts. The rail line could join the route for heavy-haul trucks north of Drill Hole Wash and cross Midway Valley Wash on a separate rail-bridge before entering the repository. Trains carrying spent nuclear fuel and high-level radioactive waste could travel along the rail line to the repository.

- Potential upgrading of the existing road that crosses Fortymile Wash with appropriately-sized drainage culverts. The road could be used by legal-weight trucks to transport spent nuclear fuel and high-level radioactive waste to the repository, as well as transporting various types of hazardous and non-hazardous materials to and from the repository.

Construction in the washes would reduce the area through which floodwaters naturally flow. During large floods, bodies of water could develop on the upstream side of each of the crossings and slowly drain through culverts. Such floods, however, would not increase the risk of future flood damage, increase the impact of floods on human health and safety, or harm the natural and beneficial values of the floodplains because there are no human activities or facilities upstream or downstream that could be affected. A

sufficiently large flood in Fortymile Wash could create a temporary large lake up-stream of the raised rail line and the legal-weight road. The water would slowly drain through culverts. If the flood occurred quickly and was sufficiently large, water would flow over the rail line and roads and continue downstream. Some damage to the rail line and the roads would be expected, but neither structure would increase the risk of future flood damage, increase the impact of floods on human health and safety, or harm the natural and beneficial values of the floodplains because there are no human activities or facilities downstream that could be affected.

During and after each flood, a large amount of sediment would accumulate on the up-stream side of each crossing. Periodically, this material would have to be removed so that future floods would have sufficient space to accumulate, rather than overflow the structures during successively smaller floods. This material would, when deemed necessary, be removed by truck and disposed of appropriately. Under natural conditions this sediment would have continued downstream and been deposited as the floodwaters receded. Compared to the total amount of sediment that is moved by the flood water along the entire length of the washes, the amount trapped behind the crossings would be small.

During a 100-year or 500-year flood, there would be no preferred channels; all channels across the entire width of each wash would be filled with water (Figure L-1). Therefore, the manmade crossings would not cause preferential flow in a particular channel or alter the velocity or direction of flow on the floodplains.

Potential construction of a route for heavy-haul trucks or rail line would require the removal of desert vegetation in the washes and the disturbance of soil and alluvium. These actions could adversely impact wildlife habitat and individuals, especially the desert tortoise, which is designated as threatened by the Fish and Wildlife Service. Prior to any construction, a biological survey would be conducted to locate and remove tortoises that are in the path of construction and other mitigation measures would be conducted as identified by the Fish and Wildlife Service during consultations under the Endangered Species Act for this action.

Construction in the floodplains could also affect unidentified cultural resources that may be present. Prior to any construction, archaeologists would survey the area following the procedure in DOE's Programmatic Agreement with the Advisory Council on Historic Preservation (DIRS 104558-DOE 1988, p. 5). DOE would avoid such sites if possible or, if it was not possible, would conduct a data recovery program of the sites in accordance with applicable regulatory requirements and input from official tribal contact representatives and document the findings. The artifacts from and knowledge about the site would be preserved. Improved access to the area could lead to indirect impacts, which could include unauthorized excavation or collection of artifacts. Workers would have required training on the protection of these resources from excavation or collection.

Potential indirect impacts on flora and fauna include increased emissions of fugitive dust, elevated noise levels, and increased human activities. Emissions of fugitive dust would be short-term and would not be expected to significantly affect vegetation or wildlife. Likewise, no significant long-term impacts to wildlife are expected from the temporary increase in noise during construction. Wildlife displaced during construction would probably return after construction was completed.

There are no perennial sources of surface water at or downstream from the Yucca Mountain site that would be affected by the use of a route for heavy-haul trucks or the construction of a rail line. Two small well ponds with some riparian vegetation occur in Fortymile Wash downstream of the point where Drill Hole Wash enters Fortymile Wash. During a 100- or 500-year flood, both riparian areas would likely be damaged or destroyed by floodwaters regardless of the existence of the crossings.

Neither the quality nor the quantity of groundwater that normally recharges through Fortymile Wash would be substantially affected due to the crossings. Water infiltration could increase somewhat after large floods as standing water slowly enters the ground behind the crossings. The total volume of these water bodies would be a few acre-feet at most, and much of the water would gradually drain through culverts or evaporate before reaching the groundwater table at 274 meters (900 feet) below the surface.

The use of petroleum, oil, lubricants, and other hazardous materials during construction would be strictly controlled and spills would be promptly cleaned up and, if needed, the soil and alluvium would be remediated. The small amount of these materials that might enter the ground would not affect the groundwater, which is 274 meters (900 feet) below the surface.

The nearest population center is about 22 kilometers (14 miles) to the south, along U.S. 95 within the community of Amargosa Valley a few miles east of Fortymile Wash. If floodwaters from a 100- or 500-year flood reached this far downstream, there would be no measurable increase in flood velocity or sediment load attributable to the use of a route for heavy-haul trucks or construction of a rail line compared to natural conditions. Hence, disturbances to the floodplains of Fortymile Wash, Busted Butte Wash, Drill Hole Wash, or Midway Valley Wash would have no adverse impacts on lives and property downstream. Moreover, impacts to these floodplains would be insignificant in both the short- and long-term compared to the erosion and deposition that occur naturally and erratically in these desert washes and floodplains.

During operation of the repository it would be extremely unlikely that a truck carrying spent nuclear fuel and high-level radioactive waste would fall into Busted Butte, Drill Hole, or Midway Valley washes or that a train would derail in Fortymile Wash. However, even if this occurred, the shipping casks, which are designed to prevent the release of radioactive materials during an accident, would remain intact. The casks would then be recovered and transported to the repository. No adverse impacts to surface water or groundwater quality from such accidents would occur.

Hazardous materials needed during construction and operation of the repository would be transported along the legal-weight access road. If these materials were released during an accident, they would be cleaned-up quickly and the affected soil and alluvium would be remediated. No adverse impacts to groundwater quality from such accidents would occur because cleanup could be completed before contaminants reached the groundwater [the groundwater table is 274 meters (900 feet) below the surface].

There are no positive or beneficial impacts to the floodplains of Busted Butte, Drill Hole, Midway Valley, or Fortymile washes that have been identified from the proposed action.

L.4.2 FLOODPLAIN/WETLANDS EFFECTS ELSEWHERE IN NEVADA

L.4.2.1 Effects along Rail Corridors

The candidate rail corridors, including their variations, would cross many small, and some large, washes. In general, the impacts caused by rail construction in any of these washes and their floodplains would be similar in magnitude to those described for Fortymile, Busted Butte, Drill Hole, and Midway Valley washes. Regardless of the corridor selected, standard mitigation practices would be used to minimize the impacts to floodplains. Most washes and their floodplains along the five candidate rail corridors are in remote areas. Impacts to these floodplains from rail construction and operation would be insignificant in both the short- and long-term compared to erosion and deposition that occurs naturally and erratically in these desert washes and floodplains.

Based on current information, springs and riparian areas that may have associated wetlands occur within three of the rail corridors (Caliente, Carlin, and Caliente-Chalk Mountain.) If the rail mode of spent

nuclear fuel and high-level radioactive waste transport in Nevada is selected by DOE, wetlands delineations along the selected corridor would be conducted and the effects would be described in a more detailed floodplain/wetlands assessment for public review.

L.4.2.2 Effects at Intermodal Transfer Stations

Neither the Dry Lake intermodal transfer station nor the northern two sites being considered for the Sloan/Jean intermodal transfer station would have any impacts on floodplains because these station locations are not in a floodplain. The Caliente intermodal transfer station, however, is located in Meadow Valley Wash, separated by the Union Pacific Railroad and the southernmost of the Sloan/Jean sites is in the area of a wash or drainage channel between Interstate 15 on the west and the Union Pacific Railroad on the east. If one of these sites was selected, DOE would conduct a more detailed floodplain/wetlands assessment for public review to address the floodplain/wetlands effects at the Caliente or Sloan/Jean intermodal transfer station location. The more detailed floodplain/wetlands assessment would also include potential upgrades to existing roads for heavy-haul use.

L.5 Mitigation Measures

According to 10 CFR 1022.12(a) (3), agencies must address measures to mitigate the adverse impacts of actions in a floodplain or wetlands, including but not limited to minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically-sensitive areas. Whenever possible, DOE would avoid disturbing wetlands and floodplains and would minimize impacts to the extent practicable, if avoidance was not possible. This section discusses the floodplain mitigation measures that would be considered in the vicinity of Yucca Mountain and elsewhere in Nevada and, where necessary and feasible, implemented during construction and maintenance in the washes.

Adverse impacts to the affected floodplains would be small. Even during 100- and 500-year floods, it is unlikely that differences in the rate and distribution of erosion and sedimentation caused by the use of a route for heavy-haul trucks or construction of a branch rail line near Yucca Mountain would be measurably different compared to existing conditions. Similarly, upgrades to access roads and placement of excavated rock stockpiles within the site area would have little affect on erosion and sedimentation from flooding events. Nevertheless, DOE would follow their reclamation guidelines (DIRS 102188-YMP 1995, pp. 2-1 to 2-14) for site clearance, topsoil salvage, erosion and runoff control, recontouring, revegetation, siting of roads, construction practices, and site maintenance. Disturbance of surface areas and vegetation would be minimized, and natural contours would be maintained to the maximum extent feasible. Slopes would be stabilized to minimize erosion. Unnecessary off-road vehicle travel would be avoided. Storage of hazardous materials during construction would be outside the floodplains.

Before any potential construction could begin, DOE would require pre-construction surveys to make sure that the work would not impact important biological or archaeological resources. In addition, the site's reclamation potential would be determined during these surveys. In the event that construction could threaten important biological or archaeological resources, and modification or relocation of the roads and rail line is not reasonable, mitigation measures would be developed. Mitigation measures developed during the pre-construction surveys would be incorporated into the design of the work. These measures could include relocation of sensitive species, avoidance of archaeological sites, or data recovery if avoidance is not feasible.

If hazardous materials are spilled during construction of the crossings or during transport to the repository, the spill would be quickly cleaned-up and the soil and alluvium would be remediated. Hazardous materials would be stored away from all floodplains to decrease the probability of an inadvertent spill in these areas.

L.6 Alternatives

According to 1022.12(a)(3), DOE must consider alternatives to the proposed action. Alternative ways to access the Yucca Mountain site are considered in the following paragraphs, along with the No-Action Alternative.

L.6.1 ALTERNATIVES NEAR YUCCA MOUNTAIN

To operate a potential repository at Yucca Mountain, heavy-haul-capable and other roads and a branch rail line to the facility would be considered so the spent nuclear fuel and high-level radioactive waste could be unloaded and emplaced underground. It is unreasonable to consider a railroad or heavy-haul-capable and other roads that access the repository directly from the west over Yucca Mountain because of engineering constraints, environmental damage, and cost associated with construction in such rugged terrain. Because of these concerns, this alternative was eliminated from detailed consideration.

Access to Yucca Mountain from the east side requires that Fortymile Wash be crossed. Alternative sites for these crossings were considered, but the impacts at any alternative site would be virtually identical to each other.

L.6.2 ALTERNATIVE RAIL CORRIDORS AND ALTERNATIVE SITES FOR AN INTERMODAL TRANSFER STATION

Five candidate rail corridors were identified by DOE through a winnowing process that considered a host of environmental constraints (see Chapter 2, Section 2.3.3). Other possible rail corridors in Nevada were examined but rejected because of such things as land use, private land, and engineering constraints. Identification of the three intermodal transfer station locations was limited to reasonable sites next to an existing rail line in Nevada. Other sites were considered by DOE, but rejected because of ownership and environmental concerns.

L.6.3 NO-ACTION ALTERNATIVE

Selection of the No-Action Alternative would avoid impacts to floodplains and wetlands. If Yucca Mountain was selected as a site to construct a repository, transport of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site would be required. In that case there would be no other practicable alternative to taking action in floodplains and wetlands because there would be no way to transport spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site during repository operation without passing through some wetlands areas and floodplains.

L.7 Floodplain Statement of Findings

DOE prepared this Floodplain Statement of Findings based on the information in the above floodplain/wetlands assessment. The assessment evaluates potential effects to the floodplains near Yucca Mountain (Fortymile Wash, Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash) and to floodplains and wetlands elsewhere in Nevada from construction of a branch rail line or an intermodal transfer station and associated upgrades to existing highways for heavy-haul trucks. The assessment describes the proposed repository project and the existing environment near Yucca Mountain and elsewhere in Nevada along each of five candidate rail corridors and at three potential intermodal transfer station locations and five potential routes for heavy-haul trucks (see Figures L-1, L-2, and L-3 for location maps).

No repository surface facilities would be located in either the 100-year or the 500-year floodplains of Fortymile Wash, Busted Butte Wash, Drill Wash, or Midway Wash. Access roads within the repository site would cross through upper portions of Drill Hole Wash and its tributaries. Stockpiles of rock

excavated from the subsurface could also affect small drainage channels. Under the Proposed Action in this EIS, spent nuclear fuel and high-level radioactive waste would be shipped to the repository over approximately 24 years. Because there is no rail access to the Yucca Mountain site, DOE would need heavy-haul-capable and legal-weight roads or a potential rail line so that spent nuclear fuel and high-level radioactive waste could be delivered to Yucca Mountain. If the Yucca Mountain site was approved for development as a repository, there is no practicable alternative to locating roads and a potential rail line in a floodplain near Yucca Mountain.

Depending on the particular rail corridor or heavy-haul route selected, route construction and operations would affect floodplains in the vicinity of the Yucca Mountain site. These effects would occur from the installation of drainage culverts to cross some of the washes (e.g., Busted Butte and Drill Hole Washes), upgrading the existing road that crosses Fortymile Wash, or construction of a bridge for rail or heavy-haul traffic over Midway Valley Wash. Activities in the washes could also reduce the area through which floodwaters naturally flow. However, none of these impacts would be expected to increase the risk of future flood damage, or increase the impact of floods on human health and safety, or harm the natural and beneficial values of the floodplains because there are no human activities or facilities upstream or downstream that could be affected. There are no delineated wetlands at or near Yucca Mountain.

Similarly, elsewhere in Nevada, there would be no practicable alternative to taking action in floodplains and wetlands because there would be no means to transport spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site without passing through some wetlands areas and floodplains.

In addition to the Proposed Action, the EIS analyzes a No-Action Alternative. Under the No-Action Alternative, no impacts to floodplains and wetlands would occur. DOE considered other alternative routes or access points to Yucca Mountain in addition to the five candidate rail corridors in Nevada and the three potential intermodal transfer station locations and five associated heavy-haul truck routes that are evaluated in the EIS. However, these other alternative routes or access points were eliminated from further detailed review on the basis of engineering constraints, environmental damage, and construction costs, and because they did not provide as direct a route to the repository as the candidate corridors and routes.

If Yucca Mountain was approved for development of a repository, DOE would choose either a rail corridor or an intermodal transfer station location and associated route for heavy-haul trucks to transport spent nuclear fuel and high-level radioactive waste to the repository. DOE would conduct a more detailed floodplains evaluation and wetlands delineation along the selected route. The effects and potential mitigation measures to be implemented for the selected route would be described in more detail in a floodplains and wetlands assessment to be issued for public review. DOE would minimize potential harm to or within a floodplain or wetland, such as by avoiding these resources in any selection of an alignment within a rail corridor.

Further, during any construction and operations at the Yucca Mountain site or elsewhere in Nevada along candidate rail corridors or at candidate sites for an intermodal transfer station, DOE would avoid disturbing wetlands, sensitive species, and floodplains wherever possible. If avoidance would not be practicable, standard mitigation practices would be used to minimize the potential impacts to floodplains and wetlands in the proposed project area and elsewhere in Nevada. Procedures would include preconstruction and biological surveys to identify and relocate sensitive species; avoiding archaeological sites (or data recovery where avoidance would not be feasible); modifying designs and implementing good engineering practices such as minimizing size of disturbance areas, topsoil salvage, preserving natural contours, surface erosion or runoff control; reclaiming and revegetating disturbed areas; and following established guidelines for hazardous materials storage and accidental spill response.

DOE's Proposed Action in floodplains would be conducted in accordance with all applicable requirements, including any applicable State or local floodplain protection standards.

REFERENCES

Note: In an effort to ensure consistency among Yucca Mountain Site Characterization Project documents, DOE has altered the format of the references and some of the citations in the text in this Final EIS from those in the Draft EIS. The following list contains notes where applicable for references cited differently in the Draft EIS.

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